

be done using liquid either alone or in combination with "barium hamburger" patties; these require serial abdominal radiographic films (normally for six hours after the solid barium hamburger consumption).

More palatable, comfortable and physiologic studies using natural foods can be done with nuclear studies. The key to the nuclear medicine techniques is to affix a radiotracer to either a liquid or a solid material for assessing and accurately quantitating rates of emptying. The radiotracers are used in minute quantities and never affect the taste of the food. The solid phase of the study is usually applied by tagging scrambled egg for consumption as an omelet sandwich. For the liquid phase, 300 ml of a tagged liquid, such as orange juice, is used. The radiolabels have been found to be stable in vitro and in vivo. Liquid and solid meal studies can be done simultaneously by using two different radioisotopes. After the patient consumes the meal, sequential acquisitions are made with a gamma camera and stored in a computer. Regions of interest are then drawn around the stomach only. Counts from this area are obtained for each sequential accumulation and a graph of the counts versus time is drawn and can be extrapolated. The decreasing counts with time represent the rate of gastric emptying. The liquid study alone takes about 20 minutes of acquisition, while the solid or combined study is usually extended out to 90 minutes.

The normal time to empty half of each tagged material consumed ($T_{1/2}$) is about 10 minutes for the liquid phase and 60 to 90 minutes for the omelet sandwich. An accelerated $T_{1/2}$ reflects an abnormality such as a dumping syndrome. Conversely, a prolonged $T_{1/2}$ reflects one of the several disorders associated with abnormal gastric retention.

Repeat studies are often helpful in evaluating the efficacy of therapy, such as a surgical procedure or the use of metoclopramide hydrochloride.

The nuclear studies described are physiologic and palatable. The amount of irradiation is less than in a barium hamburger meal and the study is more comfortable than a saline load test. A major advantage is the ability to provide more elaborate quantitative data; furthermore, unpalatability can, in itself, produce misleading results.

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REFERENCES

- Christian PE, Datz FL, Sorenson JA, et al: Technical factors in gastric emptying studies (Teaching Editorial). *J Nucl Med* 1983 Mar; 24:264-268
- Loo FD, Palmer DW, Soergel KH, et al: Gastric emptying in patients with diabetes mellitus. *Gastroenterology* 1984 Mar; 86:485-494
- Moore JG, Christian PE, Taylor AT, et al: Gastric emptying measurements: Delayed and complex emptying patterns without appropriate correction. *J Nucl Med* 1985 Oct; 26:1206-1210

Thyroid Cancer—Treatment Phase

ALTHOUGH MOST THYROID ADENOCARCINOMAS can be removed surgically, there is often uncertainty as to the completeness of the resection and the presence of local or distant metastases. For more than 35 years, radioiodine (iodine 131) has been used as adjunctive therapy in tumors that are of the differentiated cell type—papillary and follicular adenocarcinomas. It is the objective of radioiodine treatment to destroy all thyroid cancer tissue. The ability of residual or metastatic thyroid cancer to concentrate radioiodine is directly related to the serum thyroid stimulating hormone (TSH) concentration.

Optimally, serum TSH levels should exceed 40 μ U per ml. In the rare instances when TSH levels do not rise, exogenous bovine TSH may need to be given. Once adequate tumor uptake has been assured by radioiodine imaging studies, most nuclear medicine therapists recommend administering a fixed amount of radioiodine that varies from 100 to 200 mCi, depending on the extent of tumor distribution.

Following total thyroid cancer ablation, radioiodine imaging is ordinarily done at yearly intervals for three years and biennially thereafter for a minimum of ten years. If there is tumor recurrence, the patient is re-treated.

Whole-body imaging with radioiodine has been considered the most sensitive means of detecting recurrent disease. It is a formidable procedure, however, requiring withdrawal of thyroid hormone replacement therapy and periods of symptomatic hypothyroidism. Recent reports suggest that the determination of the serum thyroglobulin level may be as sensitive in detecting recurrent thyroid cancer as radioiodine imaging and may supplement or even replace it. Because most thyroid adenocarcinomas secrete thyroglobulin, a significantly elevated level in a patient receiving thyroid hormone replacement is a clear indication for radioiodine imaging. Low levels appear to exclude the presence of recurrent thyroid carcinoma. Patients who have borderline elevations of serum thyroglobulin should be restudied with radioiodine after withdrawal of thyroid hormone. At the present time, the measurement of thyroglobulin levels is best considered complementary to radioiodine imaging in the management of thyroid cancer patients.

Despite 35 years of experience, the therapeutic efficacy of radioiodine in the management of thyroid adenocarcinoma remains controversial. A number of reports have appeared in recent years, however, that indicate increased survival and decreased tumor recurrence in patients who have received radioiodine therapy. The most favorable results have been obtained in patients with cervical or mediastinal lymph node involvement and thyroid bed residuals. Results have been less rewarding in patients with surgically unresectable tumor and gross residual disease and in patients with skeletal involvement. Accordingly, in some patients, limited or no therapeutic benefit is obtained with radioiodine therapy, whereas in others, large disseminated tumor masses disappear and no evidence of recurrence of tumor tissue can be shown after 20 years of follow-up. In view of this variability in response, it is important that radioiodine therapy be used judiciously in the appropriate clinical situation and for the histologic type of tumor that can be expected to be clinically responsive.

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REFERENCES

- BlaHD WH, Drickman MV, Porter CW, et al: Serum thyroglobulin, a monitor of differentiated thyroid carcinoma in patients receiving thyroid hormone suppression therapy: Concise communication. *J Nucl Med* 1984 Jun; 25:673-676
- Hurley JR, Becker DV: The use of radioiodine in the management of thyroid cancer. In Freeman LM, Weissmann HS (Eds): *Nuclear Medicine Annual*. New York, Raven Press, 1983, pp 329-384

Radionuclide Diagnosis of Varicocele in Infertility

INFERTILITY HAS BEEN REPORTED to occur in as many as 15% of the normal population, and male infertility has been cited as the major cause in 30% to 50% of childless marriages.